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THE CLAIMS

What is claimed is:

1. A backbone cyclized peptide analog having IL-6 antagonist activity, comprising a peptide sequence of five to twenty amino acids that incorporates at least one building unit, said building unit containing one nitrogen atom of the peptide backbone connected to a bridging group comprising an amide, thioether, thioester or disulfide, wherein the at least one building unit is connected via the bridging group to form a cyclic structure.

2. The backbone cyclized analog of claim 1 wherein the peptide sequence comprises six to twelve amino acids.

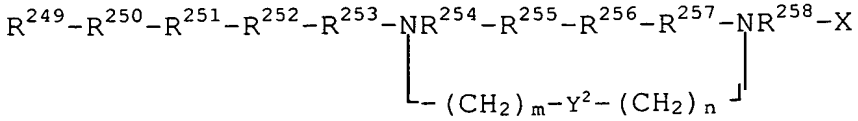
3. The backbone cyclized analog of claim 1 wherein the peptide sequence incorporates at least one D-isomer of an amino acid.

4. The backbone cyclized analog of claim 1 wherein the peptide sequence incorporates at least two D-isomers of an amino acid.

5. The backbone cyclized analog of claim 1 wherein the linear peptide sequence is derived from the IL-6 receptor.

6. The backbone cyclized analog of claim 1 wherein the linear peptide sequence is derived from the IL-6 molecule.

7. The backbone cyclized analog of claim 1 having the general formula 1:



Formula No. 1

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^{249} is Trp, (L) or (D)Lys, (L) or (D) Tyr or (D)Phe;
R^{250} is Arg;
R^{251} is (L) or (D)Leu or Lys;
R^{252} is (L) or (D)Arg;
R^{253} is (D)- or (L)- Phe;
R^{254} is Ala;
R^{255} is (D)- or (L)- Leu or is Lys;
R^{256} is absent or is (L) or (D) Arg;
R^{257} is (L) or (D) Tyr;
R^{258} is Ala; and
Y^2 is amide, thioether, thioester or disulfide.

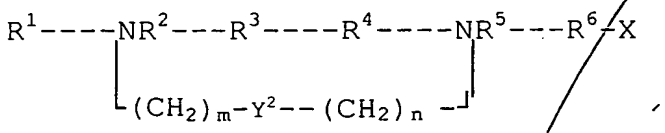
8. The backbone cyclized analog of claim 7 wherein
R^{249} is Trp, (L)- or (D)- Lys or (D)Phe;
R^{250} is Arg;
R^{251} is Lys or (D)Leu;
R^{252} is (D)Arg;
R^{253} is (D)- or (L)- Phe;
R^{254} is Ala;
R^{255} is (D)- or (L)- Leu;
R^{256} is absent or is Arg;
R^{257} is (D)Tyr;
R^{258} is Ala; and
Y^2 is amide, thioether, thioester or disulfide.

9. The backbone cyclized IL-6 antagonist of claim 8 having the formula:
Trp-Arg-Lys-(D)Arg-Phe-AlaC3-Leu-Arg-(D)Tyr-AlaN3-NH_2

10. The backbone cyclized IL-6 antagonist of claim 8 having the formula:
(D)Lys-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-(D)Leu-Arg-(D)Tyr-AlaN3- NH_2

11. The backbone cyclized IL-6 antagonist of claim 8 having the formula:
(D)Phe-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-Leu-(D)Tyr-AlaN3-NH_2

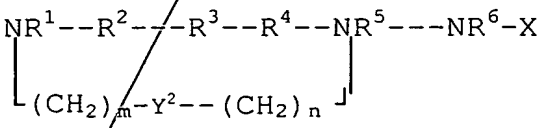
12. The backbone cyclized analog of claim 1 having the general formula 3:



Formula No. 3

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Bip, Gln, Lys, Lys(ZCL) or Dab;
R^2 is (D)Lys, Gly, Ala or Trp
R^3 is Orn, 4PyrAla, (L) or (D)Dab, (D)Arg , Lys or Dpr;
R^4 is Lys, Lys(ZCL), Arg, Arg(Mtr) or (D)Glu;
R^5 is Asn, Trp or (D)Ala;
R^6 is Arg, (p-NO_2)Phe, (L)- or (D)- Trp, Gln, Abu or Glu; and
Y^2 is amide, thioether, thioester or disulfide.

13. The backbone cyclized analog of claim 1 having the general formula 4:



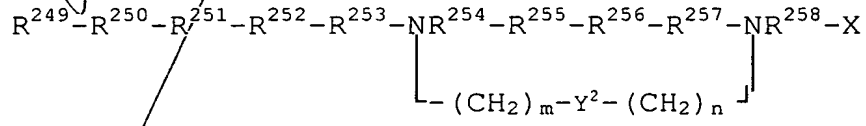
Formula No. 4

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Phe or Lys;
R^2 is (D)Cit, Lys or (D)Bip;
R^3 is Dpr, 4PyrAla or (L)- or (D)- Arg;
R^4 is HomArg, Orn or Lys;

R^5 is (D)Gln or (L)- or (D)- Trp;
R^6 is (L)- or (D)- Gln or (p-NO_2)Phe; and
Y^2 is amide, thioether, thioester or disulfide.

14. A pharmaceutical composition comprising a backbone cyclized IL-6 antagonist comprising a peptide sequence of five to twenty amino acids that incorporates at least one building unit, said building unit containing one nitrogen atom of the peptide backbone connected to a bridging group comprising an amide, thioether, thioester or disulfide, wherein the at least one building unit is connected via the bridging group to form a cyclic structure, together with a pharmaceutically acceptable carrier or diluent.

15. The pharmaceutical composition of claim 14 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the general formula 1:



Formula No. 1

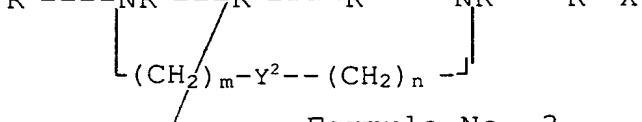
wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^{249} is Trp, (L) or (D)Lys, (L) or (D) Tyr or (D)Phe;
R^{250} is Arg;
R^{251} is (L) or (D)Leu or Lys;
R^{252} is (L) or (D)Arg;
R^{253} is (D)- or (L)- Phe;
R^{254} is Ala;
R^{255} is (D)- or (L)- Leu or is Lys;
R^{256} is absent or is (L) or (D) Arg;
R^{257} is (L) or (D) Tyr;
R^{258} is Ala; and
Y^2 is amide, thioether, thioester or disulfide.

16. The pharmaceutical composition of claim 15 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
Trp-Arg-Lys-(D)Arg-Phe-AlaC3-Leu-Arg-(D)Tyr-AlaN3-NH_2

17. The pharmaceutical composition of claim 15 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
(D)Lys-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-(D)Leu-Arg-(D)Tyr-AlaN3- NH_2

18. The pharmaceutical composition of claim 15 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
(D)Phe-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-Leu-(D)Tyr-AlaN3-NH_2

19. The pharmaceutical composition of claim 14 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the general formula 3:

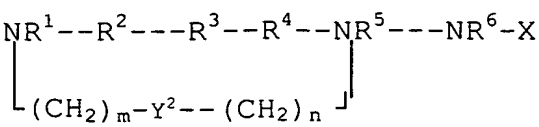


Formula No. 3

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Bip, Gln, Lys, Lys(ZCL) or Dab;
R^2 is (D)Lys, Gly, Ala or Trp
R^3 is Orn, 4PyrAla, (L) or (D)Dab, (D)Arg , Lys or Dpr;
R^4 is Lys, Lys(ZCL), Arg, Arg(Mtr) or (D)Glu;
R^5 is Asn, Trp or (D)Ala;
R^6 is Arg, (p-NO2)Phe, (L)- or (D)- Trp, Gln, Abu or Glu; and
Y^2 is amide, thioether, thioester or disulfide.

20. The pharmaceutical composition of claim 14 wherein the IL-6 antagonist is a backbone cyclized peptide analog

having the general formula 4:

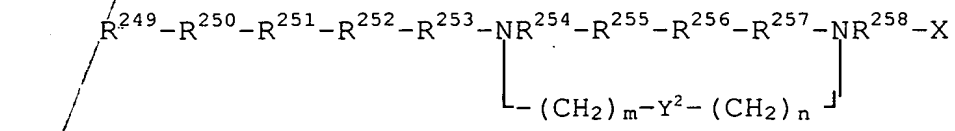


Formula No. 4

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Phe or Lys;
R^2 is (D)Cit, Lys or (D)Bip;
R^3 is Dpr, 4PyrAla or (L)- or (D)- Arg;
R^4 is HomArg, Orn or Lys;
R^5 is (D)Gln or (L)- or (D)- Trp;
R^6 is (L)- or (D)- Gln or (p-NO_2)Phe; and
Y^2 is amide, thioether, thioester or disulfide.

21. A method for treating disorders selected from the group consisting of neoplasms, bacterial, parasite and viral infections, chronic autoimmune disorders and osteoporosis, comprising administering to a mammal in need thereof a pharmaceutical composition comprising a therapeutically effective amount of a backbone cyclized IL-6 antagonist.

22. The method of claim 21 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the general formula 1:



Formula No. 1

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^{249} is Trp, (L) or (D)Lys, (L) or (D) Tyr or (D)Phe;
R^{250} is Arg;

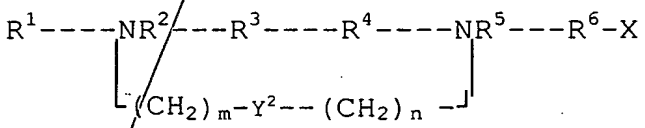
R^{251} is (L) or (D)Leu or Lys;
R^{252} is (L) or (D)Arg;
R^{253} is (D)- or (L)- Phe;
R^{254} is Ala;
R^{255} is (D)- or (L)- Leu or is Lys;
R^{256} is absent or is (L) or (D) Arg;
R^{257} is (L) or (D) Tyr;
R^{258} is Ala; and
Y^2 is amide, thioether, thioester or disulfide.

23. The method of claim 22 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
Trp-Arg-Lys-(D)Arg-Phe-AlaC3-Leu-Arg-(D)Tyr-AlaN3-NH_2

24. The method of claim 22 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
(D)Lys-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-(D)Leu-Arg-(D)Tyr-AlaN3-NH_2

25. The method of claim 22 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the formula:
(D)Phe-Arg-(D)Leu-(D)Arg-(D)Phe-AlaC3-Leu-(D)Tyr-AlaN3-NH_2

26. The method of claim 21 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the general formula 3:

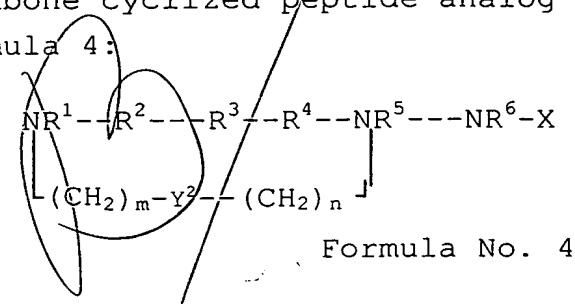


Formula No. 3

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Bip, Gln, Lys, Lys(ZCL) or Dab;
R^2 is (D)Lys, Gly, Ala or Trp
R^3 is Orn, 4PyrAla, (L) or (D)Dab, (D)Arg , Lys or Dpr;

R^4 is Lys, Lys(ZCL), Arg, Arg(Mtr) or (D)Glu;
R^5 is Asn, Trp or (D)Ala;
R^6 is Arg, (p-NO_2)Phe, (L)- or (D)- Trp, Gln, Abu or Glu; and
Y^2 is amide, thioether, thioester or disulfide.

27. The method of claim 21 wherein the IL-6 antagonist is a backbone cyclized peptide analog having the general formula 4:



Formula No. 4

wherein m and n are 1 to 5;
X designates a terminal carboxy acid, amide or alcohol group;
R^1 is (D)Phe or Lys;
R^2 is (D)Cit, Lys or (D)Bip;
R^3 is Dpr, 4PyrAla or (L)- or (D)- Arg;
R^4 is HomArg, Orn or Lys;
R^5 is (D)Gln or (L)- or (D)- Trp;
R^6 is (L)- or (D)- Gln or (p-NO_2)Phe; and
Y^2 is amide, thioether, thioester or disulfide.

28. The method of claim 21 wherein the disorder is selected from the group consisting of rheumatoid arthritis, multiple myeloma and osteoporosis.

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